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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/510,389	12/14/2004	Nobuo Ishii	101248.55500US	6492

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EXAMINER	
DHINGRA, RAKESH KUMAR	
ART UNIT	PAPER NUMBER
1792	
MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/510,389	ISHII, NOBUO	
	Examiner	Art Unit	
	RAKESH K. DHINGRA	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *03* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 December 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 October 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/20/07 has been entered.

Response to Arguments

Applicant's arguments with respect to claims 1-4 have been considered but are moot in view of the new ground(s) of rejection as explained hereunder.

Applicant has amended claim 1 by adding new limitation "a portion of the plasma processing apparatus containing the top plate portion and the antenna portion is configured such that a node of a standing wave formed at the top plate portion and in a space between the top plate portion and the antenna portion is present at a position corresponding to an outer peripheral end of the radial waveguide".

Reference (US 6,793,768 – Kazumi et al) when combined with Ishii et al reads on amended claim 1 limitations. Accordingly claims 1-4 have been rejected under 35 USC 103 (a) as explained below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention

was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii et al (US PGPUB No. 2002/0038692) in view of Kazumi et al (US 6,793,768).

Regarding Claim 1: Ishii et al teach a plasma processing apparatus (Figures 1, 9, 14, 20) for effecting predetermined processing on a substrate by exposing the substrate to a plasma production region, comprising:

a chamber 11 in which the substrate 21 is introduced;

a top plate portion (dielectric plate 13) arranged above said substrate 21 introduced in said chamber, and forming a part of a wall of said chamber 11; and

an antenna portion 30 supplying a high-frequency electromagnetic field into said chamber to form the plasma production region in a region between said top plate portion 13 and said substrate 21 located in said chamber 11, wherein said antenna portion 30 includes a radial waveguide 36 having a predetermined inner diameter, said chamber 11 has a predetermined inner diameter in a portion containing said top plate portion 12 and said antenna portion 30 (paragraphs 0048-0058). Ishii et al also teach that by using formula 27 (paragraph 0144) it is possible to compute composite dielectric constant of the space portion containing the window and the slot antenna, if other variables like dielectric constant of top plate (window), dielectric constant of the space between window and antenna (air in this case), thickness of dielectric window and the gap between the window and the slot antenna are known (Fig. 14 and para. 0144 - 0146). Based on this composite dielectric constant, value of wavelength lambda.sub.g (given in the claim) can be calculated (by using formula lambda /dielectric constant).

Ishii et al teach inner diameter of the radial waveguide (Fig. 9A), but do not teach relative dimensions of the inner diameter of radial waveguide and the portion containing top plate portion and the

antenna portion and their relationship, and also do not teach a portion of the plasma processing apparatus containing the top plate portion and the antenna portion is configured such that a node of a standing wave formed at the top plate portion and in a space between the top plate portion and the antenna portion is present at a position corresponding to an outer peripheral end of the radial waveguide.

Kazumi teach a microwave plasma apparatus comprising:

A processing chamber 2 with lower electrode 5 for supporting a substrate, with a disk shaped antenna 11 having a radius 10R, and a shield 10 having an inside radius 10R (radius of waveguide). Kazumi et al further teach that by selectively determining (optimizing) the radius of the antenna 11, and the diameter of the waveguide 10 and the dielectric material filling the space between the antenna and the waveguide, the electric field strength distribution around the antenna 11 can be controlled. Kazumi et al further teach that by controlling the gap between the dielectric window 14 and the antenna 11, position of node of standing wave of the electric field distribution can be shifted towards periphery of the plasma. Kazumi et al also teach that diameter of the processing chamber can also be used instead of the effective diameter of the waveguide to control the ratio between the central and peripheral electric field strengths (e.g. Figs. 1, 3, 7, 9-11 and col. 5, line 38 to col. 6, line 14 and col. 11, lines 1-32 and col. 13, line 52 to col. 14, line 50). Though Kazumi et al do not explicitly teach the claimed relationship B-A/2 = lambda.g/2*N, he does teach controlling the relative diameters of the antenna and the waveguide, as well as the gap between the antenna and the dielectric window, to control position of the node of the standing wave of the electric field distribution at the periphery of the antenna. It would be obvious to control the diameters of the antenna and the radial waveguide (as result effective variables) as taught by Kazumi et al in the apparatus of Ishii et al to control the position of the node of the standing wave around the antenna to control electric field distribution and plasma density at the periphery of the antenna and obtain stable plasma.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize the diameters of the antenna and the radial waveguide (as result effective variables) as taught by Kazumi et al in the apparatus of Ishii et al to control the position of the node of the standing wave around the antenna to control electric field distribution and plasma density at the periphery of the antenna and obtain stable plasma.

Regarding Claim 2: Kazumi et al teach that antenna diameter 'a' and diameter of the waveguide 'c' are optimized so that ratio of antenna diameter 'a' to the effective diameter 'c' of the waveguide can be 0.6 or above (that is, the ration can be 0.6 or higher). Further, Kazumi et al teach that chamber diameter may be used instead of the effective diameter the waveguide. Thus chamber diameter 'C' can be equal to the antenna diameter 'A' (Figs. 3, 7 and col. 13, line 52 to col. 14, line 50).

Regarding Claims 3, 4: Kazumi et al teach that top plate 14 is made from quartz (dielectric material) [col. 9, lines 10-25].

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH K. DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Rakesh K Dhingra/
Examiner, Art Unit 1792

/Karla Moore/
Primary Examiner, Art Unit 1792